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ABSTRACT

The learning module described here is designed to help teachers plan and present a lesson on mathematical proof to pupils. The main topics covered are structure, hypothesis and conclusion, analysis, contrapositive, proof by contradiction, part proof worksheet, and conclusion and posttest. This descriptive report provides information on the purposes and content of the module as well as activities and resources involved. A critique, history of development, and ordering information are also included. (DS)

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# DESCRIPTION OF TEACHER IN-SERVICE EDUCATION MATERIALS

## A. SUMMARY INFORMATION

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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**Title:** MATHEMATICAL PROOF

**Publication Date(s):** June, 1971

**Intended Users:** Teachers intersted in teaching logical progression of mathematical proof

**Grade Level(s):** 4-12

**Number:** Individuals or groups

**Primary Focus:** Helping teachers plan and present a lesson on mathematical proof to pupils is the primary focus.

***School subject(s) and/or in-service topic(s) covered:***

The main focus of the material is to help the user learn how to solve mathematical proofs. The main topics covered are structure, hypothesis and conclusion, analysis, contrapositive, proof by contradiction, part proof worksheet, and conclusion and posttest.

***What participant does in using the materials:***

The user would (1) read the introduction, (2) take the pretest, (3) read the materials and do the tasks, (4) plan and present a lesson on proof to a group of students, and (5) take the posttest.

***Resources:***

This 14 page module includes (1) introduction, (2) pretest, (3) evaluation of pretest, and (4) seven topics (listed above). The tasks are examples of each of the topics. The users would attempt to solve the problem and then check their answers with the provided answers.

***Describer critique:***

The material is difficult to understand because the explanations are too short and often too complex. The materials seem to be designed more for the high school teacher. The material would probably take 2-3 hours to complete. An instructor would be helpful.

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sets and logic

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# B. IN-DEPTH INFORMATION

**Title:** MATHEMATICAL PROOF

**Publication Date(s):** June, 1971

**Intended Users:** Teachers interested in teaching logical progression of mathematical proof

**Grade Level(s):** 4-12

**Number:** Individual or groups

**Primary Focus:** Helping teachers plan and present a lesson on mathematical proof to pupils is the primary focus.

## 1.0 PURPOSES:

The developer states the following in the introduction:

"There are several aspects of understanding mathematical proof that traditionally provide difficulty for students. This module explores some of these and provides some specific suggestions as to how difficulty might be avoided. Upon completion of this module, the teacher should be able to plan and present learning activities--or a series of them--that will help all students to write mathematical proofs.

"The module may be of assistance to any teacher who needs to organize lessons dealing with proofs. This may be the grade school teacher who is teaching concepts of integers or the high school teacher dealing with geometry, algebra, or 'analysis.'"

The major objective of the module is " to be able to plan and present a lesson on mathematical proof to pupils."

## 2.0 CONTENT — Scope and Sequencing of Topics:

The module includes seven topics in the following order:

Structure- explains that students need to be aware of the system, the framework, within which they are to work (e.g. if they are working with natural numbers, then the results of their computation should also be in natural numbers).

Hypothesis and Conclusion- gives examples of what is to be proved and what is considered "given information."

Analysis- explains what possible ways of solving a problem, looks at "reverse analysis."

Contrapositive- explains that what is true can also be proved in the negative (e.g. if A then B so if not B then not A).

Proof by Contradiction- explains how to prove a statement by contradiction.

Part Proof Worksheet - explains how proof can be presented with justifications, partial justification, and without justifications.

Conclusion and Posttest- suggests that teachers assess the skills of their pupils.

Also included in the materials is an introduction, pretest and answers and tasks, which are actually examples of each of the topics discussed.

# 3.0 ACTIVITIES AND RESOURCES INVOLVED IN USE OF PRODUCT

## 3.1 Description of main in-service activities:

The user would (1) read the introduction, (2) take the pretest (3) read each part of the module and do the required tasks, (4) plan and present a proof to a group of students, and (5) take the posttest.

## 3.2 Help given in use of product:

This 14 page module includes (1) introduction, (2) pretest, (3) evaluation of pretest and, (4) seven topics--structure, hypothesis and conclusion, analysis contrapositive, proof by contradiction, part proof worksheet, and conclusion and posttest. All instructions are included.

The developer suggests that the user should have background in logic or access to elementary books.

# 4.0 EVALUATION OF TEACHER INSERVICE LEARNING

There is a pre and posttest with an answer sheet provided by the developer. An example of one of the test questions is "describe the process of proof by contradiction and explain some of the problems that students may experience with that process."

The developer also suggests a student pre/posttest, but leaves the development of the test to the user.

# 5.0 ORDERING INFORMATION

## 5.1 Resources required/recommended:

Unless the user has a strong background in logic and math, an instructor would be helpful for additional instruction. Some of the sections, especially "Proof by Contradiction" were difficult to understand. Because one of the tasks requires the presentation of a proof to a group of students, access to a class would be necessary.

The time required to complete this module would be approximately 2-3 hours without an instructor. It can be completed in an in-or-out-of-school setting.

## 5.2 Distributor name/address:

Western Washington State College
School of Education
Bellingham, Washington 98225

(206) 676-3090 contact Office of Field Services

## 5.3 Components/approximate costs:

| Component | Purchase | Rental | No. Req. | Reusable |
|---|---|---|---|---|
| MATHEMATICAL PROOF | $.25 | - | 1/participant | yes |

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# 6.0 HISTORY OF DEVELOPMENT

## 6.1 identification of the developer:

Dale Fransson is the developer.

## 6.2 How developed and when:

The module was produced in accordance to terms of a Grant from the U.S. Office of Education to the Seattle Public Schools and Western Washington State College through the Washington State Office of Superintendent of Public Instruction. It was developed in June 1971.

A Design Team reviewed the available literature on inservice education. The Design Team prepared a set of "principles for effective inservice education," gleaned from the literature. A panel of consultants reviewed the list and recommended revisions. The Design Team developed a tentative model for effective inservice education based on the revised principles. The panel of consultants also reviewed this model. The materials were analyzed both as to content and feasibility for local implementation by ten directors of Teacher Corps Projects.

## 6.3 Evidence of effectiveness with users:

The revised materials were tested by 30 elementary teachers on the staff of one elementary school. The teachers simulated the steps through which a local faculty would proceed. Final revisions were then made in the documents.

# C. DESCRIBER CRITIQUE

**Appropriateness / adaptability / technical quality:**

If the user is able to under stand and complete this module, then s/he will be able to plan and present a lesson proof, which is the main objective of the module. The product,then, does achieve its stated purpose.

Although the developer states that this module would be appropriate for all grades, it seems to be designed more for secondary level. The examples in the tasks deal mainly with geometry and algebra. It would be difficult to adapt this material for lower grades without guidance from an instructor.

The material appears to be mimeographed and stapled at one corner.

**Content accuracy/social fairness/community acceptance issues:**

The content of the module appears to be correct. There is no ethnic or sex bias in the materials. There would be no problem with community acceptance.

**Overall summary/comment:**

The material follows a logical format, but, for the person who doesn't have too much background in math, the material is difficult to understand and sometimes very complex. The explanations are much too short.

If the developer really wanted to have grade school teachers use this module, then it would have been helpful to have examples and tasks that would be appropriate for elementary level skills.